The Student, Subject and Careers Series

GEOGRAPHY

Revised Edition

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Contents

Chapter 1 Geography and Geographers: An Introduction 1

Chapter 2 Geography and the Working World: Some General Considerations 11

Chapter 3 Occupations in Which Geography is the Foundation for a Career 15

Chapter 4 Occupations in Which Some Training in Geography is Highly Advantageous 55

Chapter 5 Geography and Living 65

In Conclusion 69

Bibliography 71

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1

Geography and Geographers: An Introduction

This book is about you and geography and careers. It attempts to bring you to some understanding of what geography is, how it reached its present state, what its methods are and how it applies to a variety of occupations. It also explores what geographers do and what skills and training you need to become a geographer.

Look closely at yourself and your capabilities as you consider the information and ideas presented here. Base your career decisions on fact. We hope that somewhere in these pages, you will find something that you can pursue further.

What is Geography?

Devising one precise definition of geography on which all geographers would agree is virtually impossible. Perhaps this is good for our purposes, because the subject of you, geography and careers is not a simple and straightforward one at all. A neat definition of geography might serve only to set your mind along one narrow path and make it difficult for you to look at the whole matter from several points of view.

Geography is a very comprehensive subject. It uses material from every branch of knowledge to study the overall picture of our environment. Environment refers to the whole complex of conditions, both human and non-human, that surround us and we are a part of. Geography has no subject matter exclusively its own.

What gives it its distinctiveness is its way of looking at and organizing knowledge; that is, its *point of view*. That point of view is best reflected in the distinctively geographical question, *Where*?

Geography involves, to a greater degree than any other subject, the *spational distribution* of things and how those things *interact.*

To ask, "*Where?*" inevitably leads to the question, "*Why is it there? What effect does it and its location have on other items? What effect do other things have on it?*" and so on.

The questions become more and more complex. Answering the important questions about our environment that geography raises is a difficult and intellectually challenging task. It is a task that can contribute much to the solving of many of the world's problems. Geography has practical value.

Geographers and the Development of Geographical Methods

Geographical methods have changed over the years, with many significant advances occurring in the past three decades. Early geography largely involved description.

Hecataeus' *Description of the Earth*, for example, was based on his personal travel and written around 520 B.C. It was mainly an account of coastlines and coastal areas with a few remarks on some inland tribes.

With time, a few writers developed less purely descriptive approaches. One method in particular combined what we now call history and geography into a type of account that went further towards explanation and looked at causes and effects.

In the fifth century B.C., Herodotus compared various cultures and their physical bases and did much to develop an understanding of the culture of Greece.

Much later, in the sixteenth century of our era, Richard Hakluyt the Elder, while at Oxford University, adopted a somewhat different descriptive approach. He applied his geographical research to the gathering and organizing of information about British trading possibilities in new areas of the known world.

At about the beginning of the last century two German geographers, Alexander von Humboldt and Karl Ritter, became the most prominent figures in the development of what is regarded as the classical period in the history of geographical method and thought.

This period saw the rise of scientific geography; a geography that employed well-established rules of procedure. This was much more accurate and precise than before and tried to arrive at well-

tested conclusions about the character of the earth.

The widely- travelled von Humboldt very carefully and systematically worked in botany, geology, anatomy, chemistry, physics, history and all aspects of what was then geography. In carrying out his work he developed important field techniques and improved several geographical instruments. These instruments included the chronometer for determining longitude and the barometer for determining altitude.

He formulated the basic method for *systematic (topical) geography* which studies the total environment through various systematic sciences, such as those referred to above. It was a system that built up knowledge of the earth topic-by-topic.

Karl Ritter led a rather secluded academic life. He viewed geography as a science basically centred on people. He tried to reveal the relationships that existed among people, history, and nature. Like von Humboldt, he made careful observations and insisted on basing his conclusions on facts, not on mere opinion or hastily contrived theory.

Much of Ritter's approach established the framework of what we know as *regional geography*. Regional geography approaches the study of the earth from a markedly different point of view than systematic geography. It sees the earth's surface as a mosaic of areas or regions, each of which has its own distinctive character.

Knowledge of the whole earth in the regional approach is built up on an area-by-area or region-by-region basis, rather than a topic-by-topic formula.

During the nineteenth century and first half of the twentieth, most geographical investigation took the form of regional studies and compiled information about the world.

Through much of this period one idea in particular stood out (reaching its height during the first half of the twentieth century) and probably provoked more controversy than any other. This was the belief that the physical environment *determines* our activities on earth. This belief or doctrine came to be known as *environmentalism* or *environmental determinism*.

Some very interesting disputes have raged over the years between the environmentalists and those who believe that nature does not determine what people do but provides possibilities and opportunities from which we can make intelligent selections.

The doctrine of environmentalism is no longer accepted as a valid geographic concept. However, it provided us with a challenging point of view and a way of organizing knowledge and approach-

ing human problems that had practical value.

Despite the impressive build-up of knowledge about the world and the refinement of geographical procedures that resulted from the regional studies by 1950 many geograhers were dissatisfied with approaches primarily concerned with studies of particular areas.

There was a growing feeling that the discipline should concentrate more on work producing important generalizations and widely applicable laws and theories about physical and man-made spatial distributions and patterns over the surface of the earth.

As a result of their efforts, a new and rigorous approach to geography developed. This was a highly scientific approach, based more on mathematical procedures than ever before.

Using sophisticated techniques of statistical analysis (collectively called *quantifying techniques* or *quantification*), today's geographers describe spatial distributions and patterns more precisely than before. They also explain them more fully and even forecast those that are likely to form in the future.

Emphasis today is on *understanding* the underlying processes that shape these distributions and patterns. The basic geographical method of *observe, describe* and *explain* has developed new and exciting extensions. It has become *observe*, *describe, analyze, explain* and *predict.*

Developments in computer technology in particular have played an important role in bringing about such changes in geographical methods. Computers allow geographers to become more sophisticated in assembling and analyzing very large quantities of data. As a result, society's power to manipulate and control its environment, and the geographer's role as a problem solver, has increased significantly.

An important recent innovation in applied geography is the rapid development and adoption of *Geographical Information Systems* (GIS). These powerful computerized tools are the outcome of a marriage of computerized mapping or cartography and modern database management software and technology.

Widely used in industry and government for information storage, retrieval, analysis and automated mapping, they are increasingly viewed as essential to modern geographical problem solving. The new methods, however, have not completely replaced or prevented the further refinement of the older ones.

Good geographers of today are not all statisticians and quantifiers by any means. Geographers still solve problems and gain

valuable insights without using advanced technical procedures and rely on more traditional approaches. A career in geography offers many different ways of doing important work.

The Scope of Geography

Despite geography's broad subject base, we can recognize the following major themes. These can give you some awareness of what the subject covers or, the *scope* of the subject. This, in turn, can help you see how a geographical education provides a foundation for the fields of work described in detail in later chapters.

The Major Themes of Geography

Geography, as we noted earlier, primarily concerns the question, *Where?* It also concerns two major systems on earth which constantly bring that question into play. Those systems are:

1. the system that links humans and their environment, and
2. the system that links one part of the surface (or region) with another.

These two basic systems have led to the development of many topics and sub-topics that various persons have used to organize their study of geography. There are too many various types to even attempt to list them here.

One scholar, however, Peter Haggett, has a way of organizing the study of geography that presents a clear picture of the scope of the subject and gives us a useful idea of what its major themes are. The following is a simplified outline of his organization. While the order of the themes is logical, it would by no means be the order that everyone would follow in studying geography.

I The Earth's Environment and the Challenges it Presents to Humans

1. The major divisions of the earth's environment: the biotic environment (the living world, including humans), the lithosphere (or earth's crust), the atmosphere (the envelope of air around the earth), and the hydrosphere (the water bodies of the earth).

2. How *productive* and *useful* the major divisions of the environment are from the point of view of human beings.

3. Changes that occur within the various divisions that affect the productivity and usefulness of each division.

4. Ecosystems. Ecosystem is the short form of ecological system. Ecology is the study of plants and animals (including humans) in relation to their environment. A study of ecosystems examines the networks of plants and animals that have formed over the earth's surface and considers food chains and plant and animal communities etc. The whole earth is one large ecosystem.

5. Environmental regions. This is the study of how different ecosystems and other subdivisions of the major environmental divisions are classified into a mosaic of distinctive areas on the earth's surface. This includes the possibilities those areas present for the support of human life.

II The Human Ecological Response to the Environment

1. Population growth and ecological growth and ecological checks on that growth - past, present and future.

2. Humans in the ecosystem. How humans have responded to the various ecosystems and environmental regions. How we have made use of them through agriculture, through tapping the earth's resources, developing industries, building cities, etc.

3. The earth's natural resources. What resources are available to us? Which ones are renewable and non-renewable? Where are they? What are the costs of developing them? How can we conserve non-renewable resources for future use?

4. The role of humans in changing the face of the earth. How much change has occurred? How are changes affected at various levels - the global, the continental, the national, and the local. Trends in land use.

III Regional Differences - a Cultural View of the Human Organization of the Earth's Surface

Culture refers to the pattern of human behaviour that a particular group of people has developed over the years and passed on from one generation to the next. There are many diverse cultural groups across the world - the European cultural group, the Chinese cultural group, the Amazonian hunting tribe - to take just three examples of various sizes and levels of development.

1. How humanity differs from one part of the world to another.

2. The distribution of cultures and the spatial patterns they form. The significance of those patterns.

3. World cultural regions. The origins of the human population. Where did the first clusters of human population develop? The growth of various cultures. The forces of change on culture, such as urbanization, mass communication and mobility.

4. Spatial diffusion. How cultural elements such as disease, fashion, bank rates, social habits, ideas, etc. start in certain places and spread over much of the world.

IV Regional Similarities

1. Urbanization - today's dominating force in the drawing together of the human population. Why more and more people cluster into cities.The forms that cities take. Spatial patterns within cities.

2. Urban systems. The distribution of urban settlements. The organization of urban settlements in size and function.

3. Worlds beyond the city: rural/agricultural areas and the impact of urban growth upon them.

4. Industrial location. Resource processing establishments beyond the city and the influence of the city as a marketplace for their locations.

5. Intercity flows: movements and flows of people, goods, services and ideas among cities. The spatial patterns of intercity flows.

1. Territories and boundaries. The many ways in which humans stake out claims to various sections of the earth's surface and the boundaries created by those claims. Regional, national and local problems. Global problems such as the oceans and offshore areas. The spatial patterns created by dividing the world into "ownership" areas.

2. Rich countries and poor countries. Patterns of, and resulting from, unequal wealth and economic and social development.

3. Patterns of inequality within countries. Regional disparities. Regional and local planning.

Would You Make a Good Geographer?

From the previous outline you should have at least a general idea of the matters which concern geographers. At this point, consider an important question: Would *you* make a good geographer?

The ideas presented in this book will help you answer this question. You should keep them in mind as you read the descriptions of the various occupations related to geography in the chapters that follow. These ideas are of particular significance to those of you interested in becoming professional geographers. However, they are also significant to those interested in knowing what secondary and post-secondary geography has to offer as training for work in other fields.

Skills of a Geographer

The following are the basic skills that professional geographers, or persons working in related fields for which geographical training is helpful, must have in high proportion to be successful in their work:

- An ability to sort through quantities of information and knowledge and to select material appropriate to your central concerns.
- An ability to perceive relationships (especially spatial) and the workings of a total complex.
- A basic familiarity with computers and their applicability in analyzing information and in problem solving, and especially the new generation of GIS.

- A facility in reading and interpreting maps and photographs and in working with some of today's highly sophisticated cartographic software and hardware.
- An ability to employ basic techniques of statistical analysis.
- An ability to do research.
- An ability to organize and carry out field work.
- An ability to interview.
- An ability to communicate effectively in speaking and writing and through the design and construction of charts, tables and diagrams.
- An ability to work as part of a team.

To prepare for a career as a geographer, begin your study of the subject in high school. Many of the basic skills and concepts of geography are developed at this level. In fact, some senior courses in high school compare very well in rigour and sophistication to undergraduate university courses.

High school subjects related to geography include history, English, mathematics, computer studies, biology, economics, physics and geology. Take as many of these courses as possible.

In the first year of university, continue to develop the broad base started in high school. This will deepen your knowledge of familiar subjects and introduce others related to geography. In later years, you may want to specialize but should never lose sight of the discipline as a whole and the position that your field of specialization occupies in it.

Photo courtesy: Richard P. Baine

Some geographers spend all or most of their time outdoors. Here, a geographer measures and checks the levels of a river.

2

Geography and the Working World: Some General Considerations

As you will have gathered from the previous chapter, geography has considerable value as a way of viewing the world and many of its problems. This chapter provides you with a broad view of the fields for which geographers are particulary well prepared.

The Major Branches of Geographical Work

The following brief descriptions of the work entailed in each of the major branches of geography will help put into perspective the occupations described later. These branches are really reorganizations of the various elements of subject matter outlined under *The Scope of Geography* in the first chapter. They cover a broad range and contain enough variety to offer many interesting choices for specialization.

Physical geographers study the earth's landforms, water bodies, climates, vegetation and soils. Particularly important contributions occur in resource management, environmental improvement, agricultural development and the selection and preparation of settlement sites.

Regional geographers, in the tradition of Karl Ritter, study all the aspects of a particular area. They look into the interrelationships of all the parts of an area's landscape. Their particular point of view enables them to see the broad aspects of regional planning and development. They also see the general perspective into which smaller-scale, everyday problems fit. Many of the case studies included in the next chapter illustrate the importance of an awareness of the total picture, especially when working out problems on a much smaller scale than that of a traditional region, such as determining the best location for a new commercial enterprise.

Economic geographers concentrate on the distribution and spatial patterns of economic activities in retail and wholesale trade, manufacturing, mining, farming, transportation, trade and communication. Many are particulary concerned with locations of facilities of all kinds and with market research. Resource management is also an important aspect of this work.

Urban geographers concentrate on the geography of cities and towns. Their work is especially important today because so much of the world's population lives and works in urban areas. In Canada, almost 80 per cent of the population is classed as urban and the proportion is still rising. Some of society's most difficult problems, such as homelessness, overcrowding, and pollution, concentrate in cities.

Political geographers consider resource management, the geographical aspects of national development policies, political boundaries, internal and international trade, international relations, and the relationship of world problems to national interests. In Canada, in particular, the political geographer can make valuable contributions to the whole consideration of national unity and regional disparity.

Historical geographers see the present landscape in the stages through which it evolved to arrive at its present character. They are likely, therefore, to understand a region's overall character more profoundly than most other geographers can. The broad view of the historical geographer is necessary in these days of extreme specialization when often the total picture of a problem fades through a preoccupation with its parts.

Cartographers are responsible for the design and drawing of maps and other forms of illustrations such as graphs and diagrams. The work they do can often express geographical concepts and relationships more clearly and vividly than any verbal description. They are constantly and directly concerned with the basic question, *Where*? Most geographers have some knowledge of cartography, because they use maps regularly.

The Major Employment Sectors for Geographers

Geographers, along with most professional scientists, find their work chiefly in three major employment sectors in Canada: teaching (including academic research), government institutions (federal, provincial, and municipal), and large private commercial and

industrial concerns.

Practising geographers are rarely self-employed. In the public and private sectors there is a wide range of occupations for geographers. Some of these occupations involve considerable field work and travel and may require long absences from home. This is especially true of work with the federal government. Geographers often work on settlement and resource development projects in Canada's remote areas.

The teacher, on the other hand, usually stays in one centre during the academic year. During the summer months however, many geography teachers find the opportunity to take on extra work or to travel. Both of course, are a form of continuing education.

Photo courtesy of: Anthony Lea, Department of Geography, Ryerson Polytechnical Institute

GIS (Geographical Information Systems) is an important innovative technology that significantly enhances the geographer's abilities.

3

Occupations in Which Geography is the Foundation for a Career

The work described for the following occupations is, in each case, the work of professional geographers, persons who gain a university degree in geography and go on to apply the knowledge and skills they learned at university in their jobs. Persons whose university education is in other related fields could be hired for basically the same occupations but would not be likely to approach the work in the same way and would not be regarded, professionally, as geographers.

In the following descriptions of these occupations there is information about the nature of the work, the preparation needed to do it, the working conditions, opportunities for advancement and the advantages and disadvantages of the work.

The section on teaching and the case studies in particular reveal a great deal about the nature and applicability of geography and the kinds of knowledge and skills a person must have to be a successful geographer.

Teaching Geography

Teaching Geography in Elementary and Secondary Schools

Several points have already been stated about the nature of geography as a subject. To give you a clear picture of the duties and responsibilities of a geography teacher, we will review some of these points.

Because geography uses a wide range of subject matter from the various branches of knowledge, its scope is unusually broad. This breadth offers the prospective geography teacher the opportunity of selecting material to learn and teach from an array of interesting topics.

Geography's comprehensiveness, however, creates problems for the teacher. It is extremely difficult to get on top of the body of material that geography encompasses and to see it in some kind of perspective.

While geography teachers generally try to learn all they can about related subjects, they cannot possibly remember every fact and detail and cannot always have the answers to students' questions. Geography teachers may feel overwhelmed on occasion by the pressures of the knowledge explosion.

For this reason, they must be clear about their teaching aims and objectives. They must be well enough informed about the subject to know precisely the concepts and understandings from which their students will benefit the most. They must carefully select the subject matter that will bring their students efficiently to those concepts and understandings and not worry about what they may have to neglect.

Geography lends itself more readily to a variety of teaching methods than most subjects. A laboratory on map interpretation, a debate on foreign policy, a field trip on city structure, a simulation on the computer, a question and answer discussion of regional problems, a lecture or demonstration of earth-sun relationships and experiments on the sand table, a compilation of data from the recording barograph - all these learning situations and more might occur in one short teaching week. Geography is enormously varied in teaching method because it is so varied in its subject matter.

To study geography today is to come face to face with the world's overriding problems such as international relations, population growth, food supply, environmental quality, racial strife, and resource management. The immediacy of geography makes it especially relevant and interesting.

Teachers who engage their students in a consideration of these topics usually find student interest high. They have the satisfaction, too, of knowing that what they are doing is of real worth in the overall development of their students.

Since geography emphasizes the spatial distribution and interactions of things over the earth's surface, geography teachers use many audio-visual aids and geographical instruments in their work. They must understand the basic working of a variety of projectors, cameras, computer hardware, etc. In addition to general knowledge, they should be skillful interpreters of maps and photographs, efficient organizers of field trips, and competent draftspersons. An ability to draw and sketch is very helpful, but not essential.

Professional geographers now use precise, mathematically-based statistical techniques. However, the introduction of these techniques into secondary school geography courses has been very slow and spotty. It is possible for a geography teacher to teach courses from the lowest to the highest grades without ever having to use quantitative analysis. This is unlikely to continue to be common place. Some teachers will have to learn at least the basic skills in handling them.

In Canada, geography is taught either as a separate subject or as part of social studies in the various school curricula. Most geographers prefer to teach it as a separate discipline. However, it can make valuable contributions as a part of a well-conceived social studies program with its own concepts, skills and point-of-view. Some school systems include geographical topics in a social studies program in the earlier years, and present geography as a separate subject in the senior years.

The geography teacher today has considerable freedom in designing and teaching courses of study and many find this to be a major attraction of the profession.

Geography teachers, along with all teachers of academic subjects in the elementary and secondary schools, need university degrees but not necessarily honour or specialist degrees in geography.

Teacher candidates either take a teacher education program after their academic degree (called the consecutive program), or take their academic degree and their teacher education degree together (called the concurrent program). Some universities offer a consecutive program and others a concurrent program. The prospective teacher should carefully consider which program would be more suitable before deciding upon which university to attend.

After completing the teacher education program and obtaining a degree, the provincial ministry of education usually awards the candidate a teaching certificate on the recommendation of the candidate's university. Such a certificate licenses the candidate to teach in the province awarding the certificate.

Usually, a certificate granted by one province makes it possible for the person concerned to teach in another province under special permission for a limited period. If a person wishes to become actually certified in the second province (to teach there permanently or for an extended period) he or she usually must follow a few minor professional procedures required by the second province.

Teaching Geography in University

Much of the previous information, especially regarding secondary school teaching, applies to university geography teaching. There are, however, some very important differences.

University teaching requires a long period of rigorous academic training and specialization. Often, it is not possible to gain university professorships with just a master's degree. A person must have a doctoral degree. Competition is high in university teaching and only the most promising scholars get the positions available. Unlike the elementary and secondary school teacher, the university teacher does not have to take any formal teacher training.

University teachers have some important advantages over secondary school teachers. They are given time and facilities to concentrate on their specialties. They usually must carry out advanced research in those specialties.

They enjoy greater academic freedom than the typical elementary or secondary school teacher, and because they normally have fewer classes, their schedules are not as tightly controlled by teaching timetables.

University salaries are usually no higher than those of experienced secondary school teachers. In many small universities they are lower. Frequently, however, university teachers can supplement their basic incomes by doing consulting work for government agencies and private business and writing textbooks.

Teaching Geography at the College Level

There are many post-secondary institutions that are not universities in the traditional sense. Some are degree-granting institutions and some are not. Their geography programs can be decidedly practical and career-oriented programs that emphasize the application of geographical knowledge, methods, and techniques in the various professions and occupations of the working world.

To get a position as a teacher in most of these institutions today, the geography graduate usually must go through as rigorous and specialized a program as that required for the university professor. Most of them will have gained a master's degree and many will have gained a doctoral degree. Again, little or no formal teacher training is usually required.

Geographers in Business, Industry and Government

A growing demand for geographic skills is presenting geographers with an exciting range of career paths. Today, geography graduates are enjoying an extensive range of new opportunities both in the public and private sectors.

Case studies of recent geography graduates illustrate the wide variety of potential occupations open to geographers.

Work in Retail Location Analysis and Marketing Research

The most encouraging increase in the private sector demand for geographers is in the area of retail location analysis and marketing research. Indeed, this field has become a distinctive specialty within the broad area of economic geography.

When a firm decides to locate a new branch or unit of its operation somewhere, it intends to set up the unit on that site for a long period and must invest a large amount of money to do so. Location research helps to reduce the risk of making an unwise decision.

Many multi-unit activities such as banks, fast-food chains, convenience stores or supermarkets are constantly considering new sites or evaluating existing locations. In the competitive business environment of these activities, location is often the single most important factor in an individual unit's success. Because of the duration, cost and importance of this investment decision, larger firms commonly have their own teams of location analysts.

Since marketing is the process of buying various goods and services from the producer and getting them to the consumer, marketing research entails more than just location analysis. Other marketing problems geographers employed by retail firms typically deal with are:

- the examination of an area's socioeconomic and demographic (population) characteristics (income level, etc.) to identify target markets (an attempt to match the right products with the right consumers)
- the analysis of market potential and market share (work in which analyses are made to determine the share of a total market that a particular branch or product has or expects to capture)

- the establishment of sales quotas and marketing territories
- the analysis and selection of efficient distribution channels (transportation facilities that are available for moving products from producer to consumer)

Since all of these business problems involve a consideration of where people and products are (either in the form of the location of consumers, transportation systems or accessibility to various sites), the geographer's spatial approach to problem solving is a definite asset.

Building upon this *spatial perspective*, the effective geographer takes courses in statistics, computer applications, economics, business marketing, and management.

The following case studies of actual recent geography graduates portray some of the career possibilities in this field of study.

Case Study #1: Dave L.

Dave L. graduated with a four year honours degree in geography with a strong emphasis in location analysis. To supplement his basic economic geography background, he chose electives in economics and business marketing.

His undergraduate thesis topic, *The Location of Head Offices in Canada*, allowed him to study private decision-making patterns of big business while his summer employment between the third and fourth year at a provincial Ministry of Treasury and Economics provided insight into the kind of work available in the public sector.

Upon graduation, he gained full-time employment in the same ministry as a regional economist, but after one year decided to return to graduate school. His decision to return to school was based upon his growing awareness that a graduate degree was necessary for quick promotion. Furthermore, he decided to pursue a career in the private sector.

Dave successfully completed his MBA (master of business administration) degree and a major supermarket chain immediately hired him as a manager in its store location division.

In this position he identified and evaluated promising new grocery store locations, conducted market research and supervised a number of property purchases. His geographical education provided many of the actual methods of site analysis used by the

company. The basic skills used daily included written and oral communication skills, report writing, computer analysis, and problem-solving research methods. Dave appreciated the opportunity for travel and field work approximately two days a week.

Dave now has a key management position as director of shopping centre development for a major Canadian development firm. He is responsible for planning new shopping centres, estimating trade areas and business volumes, obtaining the necessary development approvals, and selecting the "right mix" of retail tenants.

Dave feels that the geographic point of view he developed during his undergraduate years, combined with the business and management training provided by his M.B.A., have stood him in very good stead in this highly demanding industry.

Case Study #2: Nancy R.

Nancy R. graduated with a geography degree specializing in locational analysis. On graduation, she worked for the Hudson's Bay Company where she spent more than two years as a senior research analyst.

She then moved to Bramalea Limited where she was manager of their land development division for four years. Nancy then spent two years starting Marketscope, a market research consulting company servicing retailers and developers.

She is now development coordinator for Trilea Centres Incorporated, which owns, leases and manages some 14 million square feet of retail shopping space in Canada.

Typical projects involve coordinating the municipal and provincial approvals necessary to develop or expand new or existing shopping centre sites. Nancy manages a team of consulting planners, architects, engineers, lawyers and brokers. She assists in site investigation and acquisitions or dispositions, as well as overseeing hearings at the provincial municipal board.

Nancy's experience in location and land analysis over the years has complemented her initial training, to make her a successful professional.

Case Study #3: Anne G.

Anne G. has followed a diverse career path since graduating in geography, specializing in locational analysis. When Anne graduated she worked in the public sector as an analyst with a metropolitan corporation. She then moved into the provincial public service, first in the Ministry of Industry and Trade, and then the Ministry of Treasury and Economics, as an industrial and economic research analyst.

Anne left the public sector in 1985 and took a position with Compusearch, a large national market and social research company.

Anne's current position is director of development and marketing of the company's main products, *Market Data Services*, which provides clients with demographic and proprietary data; and *Corporate Marketing,* which deals with Compusearch's overall marketing and promotional strategies.

Anne has developed her database analysis skills to a high degree over the years since she graduated. She has built on the solid base of training she received in small area database management and analysis as part of her geography degree work.

Case Study #4: Chris P.

Chris P. selected an undergraduate program that provided a practicum or internship experience as part of the curriculum. During her studies she became interested in retail location and marketing geography and selected related options in business marketing, economics and real estate development.

Between the third and fourth years of her program she completed her compulsory summer work in the branch planning office of a major trust company. The university monitored this work and considered it relevant to her studies. She was given the opportunity to work with other, more senior, location analysts on the construction of models for evaluating new branch sites.

Her primary responsibility was to gather information, enter it into a computer and then perform basic analyses under the direction of company personnel.

This experience provided much useful insight into the types of locational models used by the company in their decision-making

practices. It also allowed Chris to meet people in the field and gain an understanding and appreciation of this type of work environment. In fact, it was this trial run that convinced her to pursue her career in this line of work.

As a result of her work experience, she gained access to a data set that became the foundation of her undergraduate thesis entitled, *The Spatial Impact of Automation on the Retail Banking Environment.*

Upon graduation, Chris secured employment with the same trust company. Since a senior company executive was an outside examiner on her undergraduate thesis, the company was completely aware of the progress she had been making as a senior student.

She joined the company as a branch location officer. Her initial responsibilities were to evaluate all existing company sites to distinguish which location factors would be the most influential in generating revenue at specific sites. The company used this information to help construct a company location model for the identification of new sites.

She then moved on to head a team of analysts who developed a strategy for introducing automated tellers to the company and identifying location sites.

Chris found her work challenging and rewarding. She considered working toward a master's degree in either planning or geography. While considering a promotion, which would lead her into areas less directly related to geography, a major market research firm specializing in geodemographic and retail site evaluation research offered her a position as a research analyst.

She accepted this position and has continued to work on a wide range of applied geographical problems, several of which have been for banks and trust companies.

In the professional community, she is recognized as a geographer with specific skills in quantitative location decision-making and geographic target marketing.

Work in Industrial and Regional Economic Development

Industrial and regional development, a sub-area of economic geography with a strong locational emphasis, offers a variety of career possibilities to geographers. While this field provides some employment opportunities in the private sector, most positions filled by geographers in recent years have been in one of the three levels of government: federal, provincial, or municipal.

Geographers work in the private sector of this field either as locational analysts in large firms deciding on the siting of new plants, or with consultant companies providing this type of advice to manufacturing clients.

From the company owner's perspective, questions arise about the cost of getting labour, raw materials and services, the regulations associated with zoning by-laws, building codes and incentive programs, and the strategies and costs associated with breaking into a new market. Because of the competitive nature of this field, the geographer seeks the best possible location to increase long run profits.

A broad range of similar careers exists in public sector organizations. Here, the basic unit of study is the area or region and sometimes the manufacturing plant or some other economic enterprise that creates employment.

In the public sector, however, emphasis is on understanding the economic impacts of enterprises on their labour forces, their communities, their regions or their provinces rather than on locational needs. Examples of the types of problems addressed by industrial geographers working in the public sector include:

- analyzing an area's general economy to identify the kinds of employment
- generating activities that would be best suited for the area
- monitoring and measuring the impact of employment fluctuations and trends on local and regional economies
- developing policies to correct the economic imbalances between areas
- designing strategies for attracting economic activities into slow growth areas

Again, the spatial perspective of the geographer is a definite asset for work in this field. Economic activities are at various sites

on the earth's surface and they interact and trade among themselves in complex ways.

Geographers, trained to see the total picture, can conceive of the economy of an area as a set of interrelated activities at various locations, with each location capable of examination on its own.

This *spatial systems* approach allows the geographer to separate, or "breakdown", large complex regional problems into parts for analysis.

Given this perspective, plus well-developed research skills, the industrial geographer becomes a regional economic problem solver.

Typically, geographers pursuing careers in this field supplement their geography specialization with courses in economics, business marketing and management, and urban and regional planning. The career paths of three such industrial geographers are detailed in the case studies below.

Case Study #5: Rob S.

Rob S. had already pursued his interests in manufacturing location analysis before graduating with his four year degree. Following the third year of his program, he successfully completed his internship in the regional development branch of a provincial Ministry of Treasury and Economics.

Rob felt that his internship provided an excellent opportunity to experience firsthand the type of research and policy work associated with this level of government and to gain insights into the way it works.

It was during his internship that he identified the topic of study for his fourth year senior research paper entitled, *The Impact of the Tokyo Round of GATT (General Agreement on Trade and Tariffs) on Manufacturing in Ontario: A Case Study of Peterborough*.

During his undergraduate work in geography, Rob registered in several professionally related courses in marketing and urban and regional planning.

Upon graduation, Rob began his career in the same branch in which he had completed his internship as an Economist I. One of the major studies he carried out during his first year at the ministry was a projection of the impact of the effects of slowdowns in the automotive industry on other sectors of the provincial economy.

Following two years at Treasury and Economics, Rob moved to the sector analysis branch of the Ministry of Industry and Trade as an Economist II. Recently, he accepted a promotion to the level of Economist III.

He is now with the small business branch of the same ministry. His responsibilities range from writing policy documents on small business and entrepreneurial development to evaluating the impact of new government programs on small business.

Rob's background in geography was appropriate for the types of tasks he performed. He is satisfied with his rate of promotion.

When asked whether he would recommend changes in the geography program that he took, he said that he should have taken more electives in economic theory.

Case Study #6: Ron R.

Ron R. entered his geography program as a mature student. He was in the work force for eight years when he decided to return to university and pursue his high school interest in geography.

His maturity and strong motivation allowed him to overcome his initial problems with statistics and report writing. His interests and experiences in manufacturing influenced his decision to pursue a career in industrial geography.

Following his third year, Ron completed his internship in a municipal planning department. His major task was to coordinate an extensive survey of all manufacturing plants in the city to predict growth.

This field work became the basis of his fourth year research paper entitled, *An Analysis of the Industrial Structure of the City of Oakville.* One of the major goals of this study was to determine the degree to which the entire local manufacturing economy was tied to the Ford Motor Company of Canada plant.

After graduation, Ron worked a municipal economic development officer. His responsibilities there included:

- conducting preliminary analyses for new firms considering the city as a potential home
- assisting local manufacturers with minor zoning problems caused by projected expansion or takeovers
- promoting the city at international manufacturing fairs and conventions
- tracking industrial change in the municipality

As well as focusing on economic geography, Ron took professionally related courses in marketing, business management and economics.

This career has allowed him to pursue his interest in geography as well as his strong desire to work in, or with, the private sector. In later discussions, Ron has said that additional courses in politics and public administration would have been very useful in his chosen profession.

Case Study #7: Chris T.

Chris T. graduated with a four year degree in applied geography. Like Rob S., he had decided to focus on industrial geography after second year and obtained an internship with the Ontario Development Corporation (O.D.C.). The purpose of the Ontario Development Corporation is to maintain and generate employment.

The major assigned tasks during his four month practicum called upon his research and computer skills in the development of an information system containing data on all plants receiving loans from O.D.C.

During his fourth year, he not only worked part-time at O.D.C., but also used their data fields as the basis of his research paper entitled, *Development Finance and Small Business: A Regional Analysis*.

Before graduation, the O.D.C offered Chris a full-time position as a research and financial officer. Since that time, the O.D.C. has promoted him to loans officer and he is the second person in charge of all loans issued to small businesses in Eastern Ontario.

While the geographic concepts and techniques that were the focus of his degree are not used daily, his research skills, systems approach, and understanding of spatial aspects of the economy are the keys to his work.

His minor in marketing and contemporary economics complement his generalist geographic skills.

In discussing his success in the job market, he suggested his prior experience through summer positions allowed him to be productive immediately and removed any "down-time" associated with training an individual to be productive in a new work environment. His education and training permitted him to take a broad view of industrial and economic development.

Work in Tourism and Park Planning

Our society's growing emphasis upon the availability and the quality of leisure presents a variety of opportunities for geographers in the recreation and tourist industry.

Geographers are assuming an expanding role as research analysts in urban and rural recreation programs, park planning, recreation resource management, tourism market segmentation, and regional tourism development.

For this section, we have classified employment opportunities into two groups: tourism and park planning.

The tourist industry offers employment in both the public and private sectors. While some geographers work in the development and management of recreation activities, the majority perform the research function of exploring how various economic, social, and environmental factors influence tourist operations.

Types of research projects range from a micro feasibility study for a new marina or ski lodge to a macro marketing scheme that develops a strategy to market the particular tourist attractions of a region, province or country. A feasibility study, for example, would require the application of some skills in a series of defined tasks including:

- identification of a target market and the distribution of consumers within it
- measurement of the market potential of alternative sites
- description of the attributes of transportation facilities
- evaluation of the impact of competitors
- examination of environmental influences
- translation of information into cost estimates

Park planning, on the other hand, is usually carried out by public employees working at all three levels of government. The only exceptions are planning projects sub-contracted to private consultant companies.

At the federal level, the major employer is Parks Canada which has responsibility for the design, maintenance and management of Canada's national parks. Similar agencies exist at the provincial level.

Most provincial parks are the responsibility of the Ministry of Natural Resources. At the regional or municipal level, there are conservation authorities and urban park systems requiring park planners.

At present, recreation geographers perform a major role as park planners in each of these jurisdictions. Again, the geographer's broad-based approach to problem solving is useful for the identification of trends and issues and for the selection and construction of appropriate research designs. Specifically, the recreation geographer uses skills that include:

- terrain evaluation (determining whether or not the surface features of an area are suitable for park development)
- field research methods
- map interpretation
- air photo interpretation
- working with statistics
- market potential analysis
- computer applications

Typically, the geographer supplements these skills with courses in economics, marketing, tourism management, and leisure studies. Below are case studies of three recent recreation geography graduates.

Case Study #8: Arnold P.

Arnold P. worked immediately upon graduation as staff geographer and project development planner with the environmental applications branch of a large municipal parks department.

While he focused his undergraduate studies in the areas of resource management and recreation geography, he had neither work experience nor thesis research experience in park planning.

His initial responsibilities were in the area of data gathering and cartography. He found his geography background provided sufficient breadth to allow him to undertake a variety of tasks.

His duties have expanded to include working out offers on capital projects, site planning, master planning, and committee report preparation.

Arnold was recently promoted to senior park planner. Although he originally expected to be outdoors on a typical working day, he has found as his responsibilities have increased, so have the demands to attend meetings and to work in the office. He now estimates that he spends an average of one day a week in the field or on a project site.

He has found his geography background appropriate for his career. In order to advance it, he must continue his education. He believes additional night courses in accounting and finance are useful.

Case Study #9: Craig W.

Craig W. graduated with a four year honours degree in geography with a strong emphasis in recreation geography. To supplement this interest he selected professionally related electives in economics and tourism management.

During his summers, Craig worked at Ontario Place and rose to the position of supervisor of the marina between his third and fourth years. Using data gathered during that summer, he wrote his undergraduate research paper on *The Comparative Characteristics of Ontario Place Marina Clientele.*

Craig effectively used his geographic background, work experience and interest in marinas to gain the position of assistant marine coordinator at Harbourfront in Toronto.

His responsibilities may, to a large extent, be classified as public relations with an emphasis on the coordination of marina events with other Harbourfront activities and the scheduling of arriving and departing pleasure boats. He particulary enjoyed the opportunity to assist in the organization of a Tall Ships Pageant.

Craig now spends the winter months indoors, planning his busy outdoor summer schedule. He feels that his geography degree and first job are good starting points for a career that he hopes will either take him into other areas of tourism development or help him to become a private marina operator.

Case Study #10: Susan S.

Susan S. has a background very similar to Craig's. She combined recreation geography and marketing as her two major areas of interest.

Relying on her questionnaire and interviewing skills, she completed her geography internship with the marketing department at Ontario Place. Her task involved the design and implementation of an extensive marketing survey of on-site visitors.

She then wrote a thesis entitled, *Market Segmentation of Ontario Place,* a thesis concerned with differentials in the age, sex, origin, etc. of Ontario Place visitors.

As a result of the quality of her study, the marketing department of Ontario Place hired her on a contract basis. Her responsibilities include market survey coordination, development of master marketing strategies, and public relations.

She enjoys the work environment and her specific duties. However, she would prefer a full-time position rather than the uncertainty of renewing one-year contracts.

Work in Resource Management and Environmental Analysis

The natural resources of a country include minerals, water, trees, areas of scenic and recreational value, wildlife and soils, to mention a few. Canada has many natural resources.

Recently, Canadians have realized just how easily these resources can become depleted and lost forever through unwise use. Resource evaluation and management is more important to us today than ever before.

Typically, resource evaluation and management projects require the coordination of many professional people.

This comprehensive field usually involves all three levels of government. The federal government, through departments such as Environment, Agriculture, Transport, Native Affairs, and Northern Development, initiates and carries out resource management projects of many kinds, usually on a large scale.

Provincial and municipal governments work on projects of a comparatively smaller scale, ranging from the drainage basin of a major river system to a conservation area for a small region.

Geographers in resource management may find themselves doing specialized work as part of a large team - especially if they have concentrated in graduate school on some narrow field such as soil chemistry.

However, often it is their job to coordinate individual resource studies and bring them together for presentation in one integrated report. Economists, planners, development agencies and politicians all use this type of report.

In doing this, geographers must consult with foresters, geologists, soil scientists, ecologists, and others.

As a resource evaluator, the geographer is likely to use special mapping techniques, interpret aerial photographs and process complex statistical information through a variety of analytical procedures.

Economic development not only severely reduces natural resources, it also affects the quality of the natural environment. As a result, there is a constant need to monitor and analyze our environmental systems.

If we view our natural environment as one comprehensive resource in itself, then it becomes clear that the sub-fields of resource management and environmental analysis have common goals.

In environmental analysis, and is what has now become known as environmental impact assessment, there is more emphasis placed on measuring change in the quality of our environmental systems and assessing the impacts of human developments on natural systems.

The results of this type of research are used as the basis for environmental protection policies aimed at preserving nature for future generations. With an understanding of ecosystems and human-environment relationships, geographers have major roles to play in this crucial field.

Four case studies presented here illustrate typical career paths in this sub-field of geography.

Case Study #11: Craig N.

Craig N. graduated from university with a geography degree. He specialized in environmental impact analysis. Craig moved into a career path with the provincial civil service, working initially as a lands planning technician with the Ministry of Natural Resources.

He then moved into the Ministry of the Environment as an environmental officer where he investigated environmental complaints, undertook various environmental inspections, assured adequate clean-up of hazardous waste spills, and collected and presented evidence for court proceedings.

Craig is now a planning evaluator with the approvals and planning section of the Ministry of the Environment. As part of his job, he reviews subdivision plans, official plans and official plan

amendments to address any concerns within the mandate of the ministry.

His job requires a good deal of contact with industry, municipal and provincial authorities, planning departments, lawyers and the public. Craig has also obtained several certificates of competency from the Ministry of the Environment to complement his university degree.

Case Study #12: Dave K.

Dave K. graduated with a four year honours degree, specializing in resource management and environmental analysis. He complemented his geographic studies with professionally related courses in survey engineering and ecology.

Between the third and fourth year of his program, he completed an internship with a municipal/regional conservation authority and this experience provided the basis for his senior research paper entitled *A Management Scheme for the Conservation Authorities' Conservation Services Program*.

Following graduation, Dave worked as a resource planner for a regional conservation authority. Here, he designed and coordinated watershed management plans.

Dave felt his academic background and previous experience were ideal for the job. He enjoyed the opportunity to spend up to three days a week in field work, but soon found the responsibilities too much a matter of routine.

After two years, he took on a new job as conservation authority liaison officer for the provincial Ministry of Natural Resources.

His major responsibilities now include interpretation of ministry policy, guidance in the development of watershed and master plans, coordination of program development seminars and approval of research grant applications.

This position of higher responsibility has reduced the amount of time he devotes to field work. However, it has allowed him to develop his management and interpersonal skills. While his geographic background continues to play a strong role in his work, he feels that communication skills are vital to his position.

Case Study #13: Jim M.

Jim M. graduated from a university geography program with a four year honours degree in resource management. He immediately accepted a teaching fellow position at an Australian university. Teaching fellows are responsible for helping in labs and seminars as they proceed toward their graduate degrees.

Jim feels his experience of teaching and studying concurrently allowed him to develop a high degree of specialization in his major area of interest, land management.

After his three year masters degree, he returned to Canada and immediately obtained a six months contract with the Federal Lands Directorate to carry on analysis and literature review of Canadian land speculation practices.

At the expiration of his contract, he worked as a full-time research officer for the land planning analysis division of the Lands Directorate of Environment Canada. He is now chief of this division. The function of his division is defined in terms of three responsibilities:

- policy, direct control over the development and implementation of all federal land use policies
- public relations, responsible for publishing a *Land* newsletter and an annual *Status of Land Report*
- planning and responsibility for the examination and evaluation of land planning techniques used to resolve land use issues

As an active practising geographer, Jim has not only achieved a senior position of responsibility in the federal service but is also a lecturer in land resource management at a local university, serves as an advisory council member to another university geography program, and sits on the editorial committee of a Canadian geography journal.

He is also a strong proponent of the need for geographers, as a professional group, to more actively market their applied problem solving skills.

Case Study #14: Anneliese G.

Since Anneliese G. graduated with a geography degree she has enjoyed a career path which has taken her from a junior planner at Delcan/RSMI to her present position of environmental planner at Dillon Consulting Engineers, Planners and Environmental Scientists.

She researches, evaluates and coordinates the preparation of environmental assessment documents and assures they meet the requirements of the Environmental Assessment Act. Typical projects involve waste management site evaluations and route selection studies. She also prepares materials for her colleagues and herself to use in their roles as expert witnesses in environmental hearings and hearings of the provincial municipal board.

While in university, she specialized in environmental analysis and resource management and she has since built on this base in her professional career.

Anneliese is now pursuing a part-time master's degree in environmental studies.

Work in Urban and Regional Planning

Urban and regional planners are responsible for the development of neighbourhood and master plans for cities and regions. They study the social, economic, political, and physical conditions of urban centres. They advise governments in matters dealing with changes in the internal structure of cities and regions.

The profession covers a wide diversity of responsibilities from those of research specialist, to neighbourhood planner, to executive planning director.

As a result of the variety of tasks associated with the planning process, there are employment opportunities for many professional specialists as well as planners. These include economists, engineers, sociologist, architects, and political scientists, as well as geographers.

Although most planning positions are in urban planning departments, there are other opportunities for geographers in regional and natural resource planning, in transportation planning, and in other areas.

Within a planning office, geographers work as land use planners, research analysts, or project coordinators. Their responsibilities often include the overall coordination of the various parts of a study. They are frequently involved in researching interesting social problems including crime, pollution, and traffic congestion.

Courses in statistics, research methods, computer applications, cartography, and systematic studies in urban geography give geographers well-developed research skills and the ability to deal with problems associated with the spatial distribution of people and activities within regions.

The ability of geographers to consider many different elements and their interrelationships in a particular area or system serves them well in this profession.

The urban planner's background places more emphasis on urban design, the political process of establishing and carrying out government policy, social planning, and interpretations of a province's Planning Act. Ideally, to plan is to be proactive rather than reactive. Urban planners diagnose potential urban problems before they arise. They develop forecasting skills and anticipate and design future scenarios.

Virtually all geographers in the planning field are graduates of honours programs or their equivalent. Many have graduate degrees either in geography or in planning itself. Geography is the most common undergraduate degree for those accepted for graduate planning degrees.

A geographer who takes an additional degree in planning is likely to advance in the profession. A planning degree from a recognized university provides eligibility for immediate certification by the Canadian Institute of Planners (C.I.P.). However, a graduate of a geography program must have three years of relevant work experience before applying for C.I.P. certification.

The following case studies provide insight into the role and opportunities of geographers as planners.

Case Study #15: Bill B.

Bill B. obtained an honours B.A. in geography from a Canadian university and an M.A. in geography from an American university.

The courses which especially related to his work as a highway planner included statistics and statistical analysis and cartography. He feels that his other courses in geography were of general

educational value. They provided him with a useful viewpoint and general line of approach, but were not strongly related to his work.

Bill did considerable summer work in statistical analysis during his senior years at university. During these periods, he was part of a large team engaged in gathering and analyzing data.

His work impressed the research geographer for a provincial Ministry of Transportation and Communications, who invited Bill to work for him.

Most of Bill's work was pure research. He processed data from a variety of surveys. Bill researched a variety of aspects of highway use. He analyzed traffic patterns in the province, studied the suitability of various road surface materials and predicted the amount of money the department would have to spend on roads in various regions of the province.

Work of this kind rarely took him into the field. He gathered, organized, and analyzed his data and made reports to supervisors, administrators and planners.The only equipment Bill used regularly in his work was a standard calculator.

Computer programmers and technicians almost exclusively handled the sophisticated data processing equipment used in his studies. However, when he introduced an analytical approach to the department, he accessed several of the machines for experimental purposes.

Geographers in urban/regional planning are now finding that, at least for the first five to ten years of their careers, they must work directly with sophisticated computer equipment. For any cartographic work, Bill used the services of the department's draftspeople.

The division in which Bill worked was very much technically-oriented. Senior personnel consisting largely of civil engineers and traffic engineers. These, he feels, are the people who can go furthest in the department. Geographers provide services for those engaged in the mainstream of the department's activities.

Case Study #16: Dick B.

Dick B.'s background in geography was broad and consisted of university courses in all the major fields of the discipline. He believes his training as a "generalist" was of great value in his line of work.

He obtained an honours B.A. in geography and completed all the course requirements for his M.A. Only his thesis - a settlement study of a major urban region in northern Ontario - remained uncompleted when he took his planning position.

Dick worked as a geographer for a private firm of town-planning consultants. Subdivision design made up much of his work. He:

(1) examined an area of undeveloped land owned by a developer who had come to the planning company for a subdivision design;

(2) drew a professionally acceptable large-scale map of the area;

(3) designed the subdivision by dividing the area into residential lots, public open spaces, commercial lots, and streets - obeying the land use by-laws of the municipality in each area;

(4) reported to, and met regularly with, the planning director, the company's engineers, certain professionals outside the company, and the developer about the progress of the work.

Dick found his work varied and challenging. It provided opportunities to employ his broad range of skills and knowledge. Directly applied skills included: drafting, statistical analysis, report writing, field studies, map interpretation, and map and chart design.

In addition to fostering these skills, Dick feels the study of geography helped him to become an effective generalist. He readily perceives the total picture of an area (or region) and considers how factors that make up an area interact.

An example of this interaction is the effect slope and geology may have on the use of land to be subdivided; in turn, the land use often causes certain physical processes such as soil erosion and stream pollution.

Dick believes his geography background provided him with good opportunities for advancement. The firm hired him with the expectation that he would learn the business quickly and, putting his broad training to good use, would eventually move into the executive ranks of the company.

Work in Geographical Information Systems

The rapid growth, acceptance and use of geographic information systems (GIS) is a recent and very important development in applied geography. These computerized systems make use of large databases storing the locations of map features.

However, they are much more than computerized mapping systems. For example, with GIS the geographer can store the location and boundaries of each building, road, river, hydro line, census district, property parcel or soil zone, and can map each feature automatically.

In addition, stored data can include the important characteristics of these features (such as the number of lanes on the road, the type of road surface, the owner of the property parcel and the assessed value of buildings on it, or the number of persons in each census district).

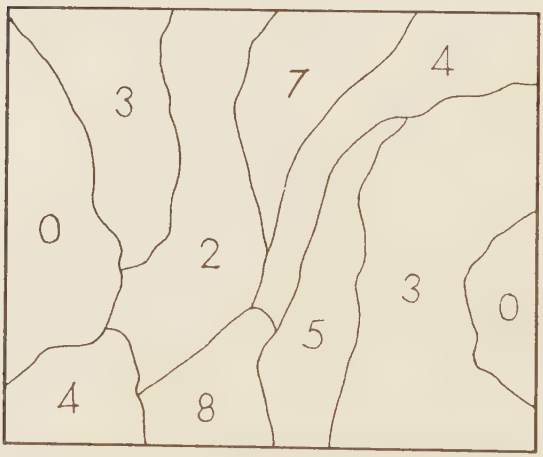
GIS considers each type of feature, for example all roads, along with a key characteristic, such as road width, as a different *map layer*. GIS can map these layers separately or combine them with any other layer for the same area, all in a single map.

As an illustration of the power of these systems in problem solving, consider the important GIS function of map overlay. Assume that the problem (research task) is to identify all small areas in a region which would be possible sites for a new solid waste landfill. Certain types of geology, soils and earth are unsuited for this purpose. Others are acceptable and still others might be good.

The geographer collects data for each of the geology and soil/earth features. The geographer uses GIS to create a separate map layer for the area. Each geological or soil area is given a suitability rating or score; for example, 9 as very suitable and 0 as totally unsuitable for a landfill site. (See Figure 1 on next page)

FIGURE 1
GEOLOGICAL SUITABILITY

SOILS SUITABILITY



Many other physical variables will influence landfill suitability. These variables might include drainage, slope, distance from rivers, forest or crop type, environmentally sensitive areas and possibly even average wind strength and direction.

The geographer uses GIS to create a *suitability score* map layer for each feature. The site must be reasonably accessible to the community which it serves. A GIS creates a map layer showing

categories of distance to town (0-2 km, 2-4 km, 4-6 km, etc.). Lower scores indicate distances farther away (higher transportation costs). A GIS does this automatically and generates a map of distances from main roads suitable for heavy garbage truck traffic.

Geographers should also create layers for other factors, such as concentrations of population, land values, existing land uses, and so on. They avoid certain land uses such as cemeteries, railway marshalling yards, orchards and, in general, land with a high value. These undesirable factors would receive lower scores on the GIS.

If geographers use GIS to score each different map layer appropriately for suitability, the final analytical task is to overlay all the layers and simply add up the scores. (See Figure 2 on next page). This task would take them several days to do "by hand". However, a computerized GIS can usually do this in less than 10 minutes.

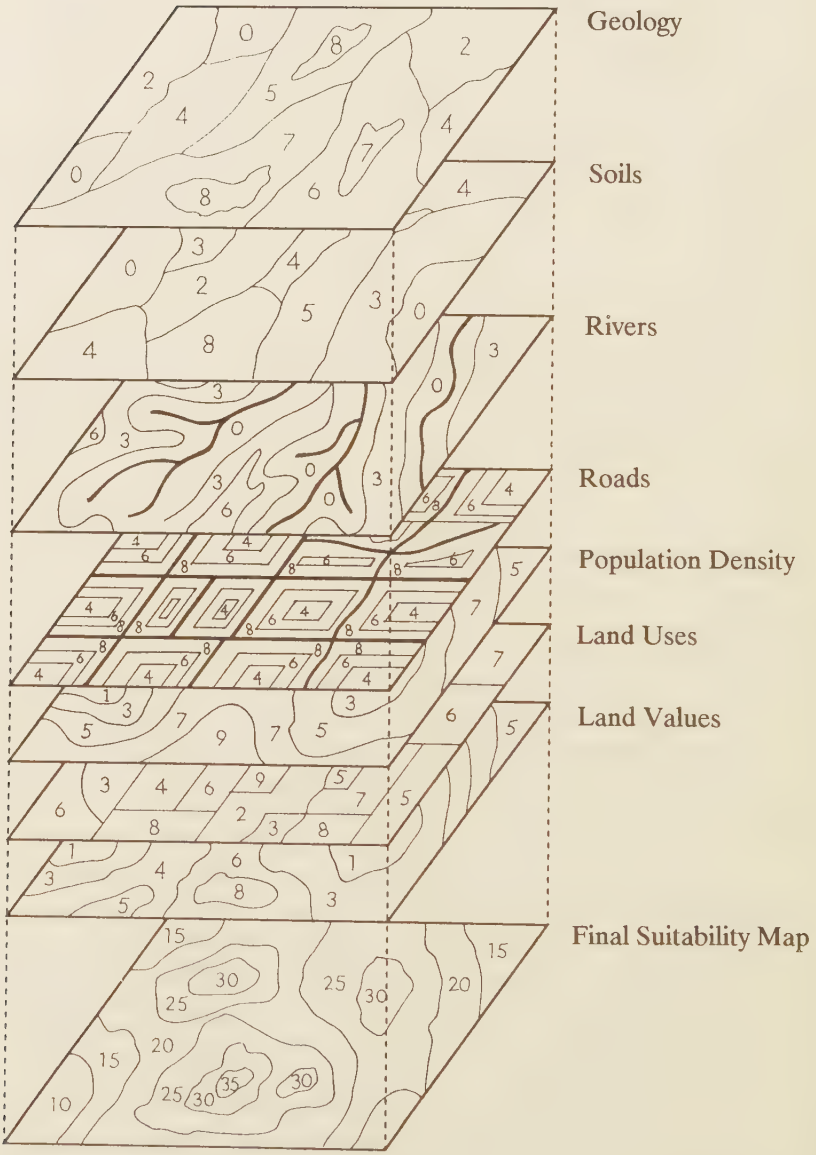
On the final map, areas with large scores are more suitable than those with small scores. If some layers are more important than others, for example soil suitability, these layers would simply be multiplied by a number greater than 1 before the addition takes place.

Map overlay is only one of the powerful capabilities of a GIS. A GIS operator can simply point to an area on a map (with a mouse, using cross-hairs) and ask the computer to describe the feature or area. This is known in GIS as *querying a location or an area on a map.*

Since GIS integrates the databases using each feature's specific geographical location as a link, a description can include everything stored in the computer for the feature or area including its age, size, land use and value, and even what features are adjacent to it. Map query is helpful for exploring a map and observing links between characteristics.

Even more helpful for many applications is the ability to search out and highlight all areas on a map that satisfy a set of conditions specified by the map analyst. For example, companies often request municipal economic development departments to provide information on suitable sites for new plants within the community. The development manager could use a computer and GIS to search for all properties (1) zoned for industrial use; (2) with no buildings on them; (3) larger than 3 hectares; (4) serviced by water and sewer lines; (5) within 2 km of a highway interchange; and, (6) currently for sale. If the data sets are current, answers to this query would be available in less than 10 minutes.

FIGURE 2
FINDING SUITABLE AREAS FOR SOLID WASTE LANDFILLS USING GIS MAP OVERLAY



Forestry firms use the same function to find the best areas for harvesting. Agricultural departments use this function to make recommendations for the best areas for growing potatoes or spring wheat.

Municipalities use GIS to keep track of a wide range of data on property parcels such as ownership, tax rate, types of buildings, zoning class designation, etc.

Real estate firms use GIS to keep track of size of lot, size of house, number of bedrooms and selling price. These systems are also very helpful in planning road, water and sewer networks for new subdivisions and communities. A specialized GIS can be used to determine the sizing and spacing of both arterial roads and pipes for new subdivisions. The data required comes from other map layers in the GIS, such as one showing planned populations.

Three-dimensional GIS systems can show elevations in three dimensions. They can compute the optimal paths for a new rail line avoiding steep slopes; work out the amount of earth to be removed for a new highway; figure out the territory which can be seen from each point along a forest access road; and indicate the territory which water would flood if a dam burst.

To engage in comprehensive planning and management of systems with a geographic dimension, many government departments, public agencies and private firms have spent a good deal of money in the last decade collecting data, acquiring suitable computer hardware and GIS software, and hiring and training staff.

There are now about 30 commonly-used commercial GIS software products which run on large mainframe computers, middle-sized minicomputers and desktop microcomputers.

Microcomputer hardware, GIS software packages, and many packaged data sets (including the Census), are now available at moderate cost. This makes powerful GIS technology affordable for smaller firms, small planning departments, school boards, conservation agencies, police, fire and ambulance departments, universities and schools.

The demand for GIS operators and analysts to manage and work with this technology has far outstripped the supply. Experts agree this is likely to be the case for at least the next decade. For most systems and application areas, geographers who use GIS will be the first ones hired. However, a degree in geography even without GIS training is the next-best background.

Some applications require specialized training in such areas as surveying, engineering, photogrammetry and remote sensing, geology, forestry, biology, and landscape architecture. Geographers often end up working with these specialists and even fulfilling these specialized roles.

The generalist background of most modern geographers means they are well-suited to working with GIS to solve a wide range of problems.

As part of the GIS revolution, the demand for large amounts of spatially-referenced data has increased tremendously. Geographers plan and execute large data collection projects for both government and industry. New firms, consulting groups and public agencies specialize in various forms of data collection for GIS applications. A common task sub-contracted to these firms is the digitization of geographical features from hardcopy maps.

Digitization is the process of moving a mouse-like device over the surface of a map and pushing buttons to record the locations of points (their horizontal and vertical coordinates) along key features such as roads, rivers, and property boundaries. The GIS operator stores the coordinates of each location in the computer by pushing a button at each key point.

New firms are also springing up which convert data from one form to another so they are compatible with different software systems. Geographers are finding interesting jobs in all these new firms.

One of the most important skills in this area is an ability to appreciate the interrelationships among a wide range of factors, especially those which have spatial distributions. The geographer must select data to collect (and collect what is required) in a high-quality form at the least cost. Therefore, this is clearly an area in which geographers excel.

Since GIS systems are new to many firms and agencies, geographers often advise managements and senior civil servants about GIS system design. This includes what data to collect (and why and how); how to store the data; what GIS software to purchase; what computer hardware platform to use; and what types of staff to hire. All these tasks are complex challenges. They require those involved to keep abreast of new data sources, new technology and new ways of integrating GIS in companies and agencies.

Many geographers collect data, introduce GIS technology to firms and agencies, design software, program and sell GIS systems. However, most geographers working in GIS today are helping

develop particular applications of GIS. This means working with a GIS system and existing databases on a day-to-day basis, producing the most useful and cost-effective information products for firms or agencies. These information products allow managers to make immediate decisions to solve particular problems.

For municipal and regional governments, geographers build information products from data map layers. These map layers include property parcel boundaries, ownership and tax status information, roads, water and sewer lines, bridges, parks and recreation facilities, land use, zoning areas, and a wide range of census variables for small census areas. Geographers can combine these and other data sets to permit very cost-effective planning and system maintenance for most municipal departments including public works, planning, police, fire, health, social services and parks and recreation.

For example, police departments use maps of various crime and accident data in relation to other variables such as population density, income and frequency of police patrol. Fire and ambulance departments use maps showing response times of emergency units as well as the incidence of fires and accidents by type.

Health and social services departments use maps which show patients/clients by age, sex, income, and language. They use maps to plan service districts, allocate existing personnel and select locations for new facilities.

For an agricultural agency with specialized needs, the data layers required may be fewer (elevations, soils, rainfall, length of growing season, existing crop types, fertilizer application rates, yields, etc.). However, the information products may require sophisticated analyses.

Forestry applications, extremely important in Canada, need information products, such as where to cut, how much wood of each type cutting would generate, how to remove the logs, where to transport them and where to replant.

For hydro companies, an important application is planning the routing of new hydro lines to minimize environmental disruption, cost of land acquisition and public opposition. For Bell Canada, typical applications involve keeping accurate inventory of the locations of all facilities, above-ground and buried lines, which switching stations serve which customers, billing areas and so on.

Government ministries and departments working with land-related mandates (including natural resources, the environment and transportation), large municipalities and public utilities such as hydro and Bell Canada, were leaders in adopting GIS technology in the late 1970s and early 1980s. The newest growth areas for the GIS industry are the municipalities and medium and smaller firms.

Retail chains and property development firms are now using GIS systems in day-to-day problem solving. Retail firms not only map their own stores but also those of competitors. They keep track of where surveyed customers live and work. They use GIS to define their trade areas, to serve and market to the households in these areas more efficiently. Perhaps most important, however, GIS helps firms to search for under-served areas which should support profitable new stores in their chains. Some food store chains, banks and fast food chains have developed very powerful GIS decision-support systems.

Property development firms are using GIS to keep track of municipal planning data, transportation routes and capacities, parking, location of competitors, complementary uses, demographic data, trade areas and more. Before a company approves a new mall, office or mixed-use development, they examine a wide range of alternative designs, layouts and "what if" scenarios in detail using GIS systems.

Development firms and urban planning departments often share their data files by simply exchanging several diskettes. In all these application areas, geographers help to develop the maps and reports which justify the substantial expense in using GIS.

In general, geographers are more involved in the planning, designing, data collection and product development stages than in the day-to-day production of reports, maps and queries.

One goal in designing and developing cost-effective GIS systems is for persons not trained in GIS to be able to efficiently use the system to produce routine products. Geographers working in GIS do not have to be computer programmers. However, a knowledge of computers and related hardware, database design concepts, and an ability to work with computers regularly are very important assets.

Most geography degree programs offer a range of "how-to" (or methods) courses. These include GIS, introduction to computing and various forms of spatial analysis, including statistics and cartography. They form a good basis for a GIS career.

There are very few programs in North America which offer specializations in GIS. Indeed, GIS is considered a tool rather than a sub-field of geography. GIS can be, and has been, effectively applied to all sub-fields of geography and many related subjects.

The following three case studies present examples of geographers working with GIS in government and industry. Again, these individuals are actual graduates from geography programs.

Case Study #17: Kathy D.

Kathy D. pursued her interest in the application of geography at university. In her geography courses she stressed statistical techniques, computer applications and urban studies. Her professionally related selections were chiefly in urban planning courses.

During her internship, Kathy worked in a municipal planning and development department. Her main task was to gather and record data on the industrial structure of the urban area. During this exercise, she recognized the limitations of storing data on charts and maps that are difficult to update and quickly become obsolete.

One of her fourth-year courses, Geographic Information Systems, provided her with an alternative technique for handling large data sets. Seeing the potential of these data handling systems, and wanting to be part of the GIS revolution, Kathy actively sought employment in this field after graduation.

Her first position was in research with a municipal planning and development department which had adopted GIS technology.

During this six-month contract she became familiar with the city's *Central Property Register*, a large computerized database operating on a spatially referenced system. Operators enter specific data on every property in the city into the register according to the property's location. This allows the computer to retrieve the data in the form of a map.

The software can also aggregate (total or sum up) data. As an example of aggregation, the system provides property data for one address; it can group a number of properties to create a city block; and it can aggregate city blocks to conform to census tracts and combine census tracks to produce data for an entire urban area.

The system can easily highlight all of the properties which have taxes owing, have industrial uses, or have city-maintained trees on them and extract these for separate analysis.

This experience became the crucial factor in Kathy's selection as a municipal research planner. In this position, she developed a GIS for the municipality.

Kathy is becoming a computer expert and has updated her skills in this area through courses and trade seminars. She feels, however, that her major asset lies in her ability to combine her spatial or geographic perspective with her computer skills. This makes her a vital key to her department's urban planning-related research efforts.

Case Study #18: Terry M.

Terry M. worked in business for a couple of years after graduating from high school. While in school, two geography courses stimulated his interest and he soon resolved to pursue geography as a career.

Terry entered a university geography program which placed considerable stress on introducing students to analytical techniques and GIS. He became interested in GIS during his first year, and this interest grew stronger with his third year GIS course.

Terry had not excelled in maths and sciences in high school. However, his interest in methods of practical problem-solving provided new motivation to work hard on these areas and to do well.

He took courses which he felt would prepare him to become a locational analyst. These included courses in urban and economic geography, location theory and practice, and methods courses. He also studied economics, public finance, public adminstration, recreation, planning and marketing, and tourism planning, as well as marketing and general business courses. All of these courses were helpful in the wide range of tasks involved in his career.

In the summers, Terry managed to find challenging jobs in which he could make use of his skills. His last summer position was with the Federal Ministry of Energy, Mines and Resources. His major project that summer was to create a large microcomputer database containing the attributes or characteristics of single industry towns in Canada.

Data included location, size, population, breakdown of employment by type of job, age, skill level, training, etc. The database was used to study the possible effects on the town's economy caused by changes in market conditions in its key industries. The

data also permitted the study of possible economic diversification in these towns.

Terry's third year courses in GIS and in retail location analysis stimulated his interest in applying GIS methods to store location research. He selected this topic for his fourth year thesis, or major research paper.

He read widely and discovered very little material on this specific topic. However, there were some interesting approaches which GIS could adapt to make store site and market evaluation easier, more thorough and precise. The final paper was well-received by his professors. They knew it was just a matter of time before geographers would actually use the approaches described.

When he graduated, Terry accepted the position of applications analyst with a rapidly growing GIS software developer. The firm hired Terry because it perceived retail location and market analysis applications would be important new markets for its GIS software. The firm's software package was priced affordably for businesses wishing to try it out in new areas of application.

Terry was instrumental in striking an agreement between the GIS firm a large national supermarket chain to jointly develop a set of routines, or protocols, which the retailer could use to better assess markets and select sites for new stores.

The retailer gave the software firm the right to develop a demonstration system using its data. This allowed other retail firms to see the potential of GIS.

Terry spent a good portion of his first working year on this application. However, because of his geography background and the rapid growth of the firm, he also worked on several other GIS applications related to marketing, urban and regional planning, and even physical themes.

Terry did not graduate as a computer programmer. However, in working in the GIS development environment alongside programmers, he quickly became proficient at many computer-related tasks. He did not write computer programs in the conventional sense. However, he developed programs for the retail application in the special computer language which his firm had incorporated in its GIS.

After two years, the firm promoted Terry to manager for commercial business development. In this role, he planned which types of commercial, retail, marketing and related firms to target and which types of applications of his firm's GIS to promote.

This required research, discussions with potential clients, preparation of presentations, proposals and demonstrations, investigations of which firms were buying GIS systems and what competitive GIS vendors were doing, and so on. He developed and implemented a business plan and marketing strategy.

Some of the applications he wanted to promote required plans to extend and enhance the GIS software with new functions to solve new problems. He interacted with the software designers and programmers to work out the best way of proceeding.

He recognized that useful data sets would increase sales of GIS software to the business sector. Terry made it a priority to keep detailed records regarding the availability and price of geographically-referenced data. He frequently met with agencies such as Statistics Canada, Environment Canada, Canada Post and many private database companies so data would be available in forms easily imported into his firm's GIS.

During this period, Terry often represented the firm, giving talks on the application of GIS at trade shows and meetings of applied geographers. He published a paper in one of the journals of the Canadian Association of Geographers.

Although he was not "in sales", he often managed the firm's booth at trade exhibitions and professional meetings in many cities in North America. He demonstrated how the system worked on problems of interest to the audience and met with prospective clients.

Since the firm was still small, Terry participated in many phases of the development of the firm and its product. This included discussions with programmers, testing software changes to make sure they worked, and training new staff.

Terry has now taken on additional responsibilities which have drawn him more into the management of the firm. However, his main responsibility is still promoting commercial applications of GIS. He is well-respected in his firm and in the industry for his general knowledge of how to develop, apply, promote and sell this new technology to solve business problems.

As Terry has advanced in his firm, he uses less and less of his geographical training. His new responsibilities call more on management, interpersonal, communication and technical skills. However, he believes his geographical education and his early research on the application of GIS to retailing and geographical marketing have provided the best background for his successful career path.

Case Study #19: Kai T.

Kai T. has a career path similar to, and actually crossing, Terry M.'s. Kai took many of the same types of university courses as Terry, stressing geographical methods, locational analysis, business, economics, recreation, planning, marketing and public administration.

One of his most interesting summer positions was with Royal LePage in the industrial real estate division. His major project was the construction of an industrial real estate database. This contained lists of industrial properties and, for each property, indicated the type of land use zone, existing industry type and size, tax rate, sewer and water servicing standards and so on.

Kai used GIS in several geography courses including a third year course on this topic. However, he did not consider himself a specialist in this area. He graduated with an A average and was on the dean's honour list.

He easily found a position of considerable interest as development coordinator with a large urban property development firm. He worked on several commercial and mixed-use development projects which the firm planned and built.

He consulted with urban planners, traffic engineers, architects and other professionals. In addition, he also negotiated and coordinated efforts with leasing agents and ultimately with tenants. He found this job both interesting and challenging. However, he was using his geography education only indirectly and he really had no particular advantage over people with other business backgrounds doing the same job.

After two years, Kai accepted a position as research analyst in the location research department of a national grocery food chain, which operated approximately 70 food stores in Ontario and Quebec. This research position was more in keeping with his long-term goals.

The grocery retailer decided to investigate GIS technology. GIS would help this department produce more and better information on the market potential of existing stores' trade areas and the projected profitability of opening new stores in other markets. In fact, the initial discussions which led to this decision had been stimulated by meetings between Terry M. and Kai's boss, who was also a geographer.

The grocery retailer hired Kai to build up the resources of the department and to support the aggressive data collection and database construction efforts of his department. Kai spent most of his time in the first year in data collection and in checking and revising data for the new GIS. However, he also helped assess several markets, new sites and competitors using the firm's traditional approaches.

Kai did not consider himself a computer specialist and rarely used a computer in his first job. However, he quickly became proficient in manipulating data on powerful microcomputers and in using the GIS system sold by Terry M.'s firm.

Kai worked with his colleagues and analysts from the GIS firm. They produced GIS approaches to assessing the market potential of areas which the retailer was already serving as well as new areas. Questions, previously unasked because they would be too expensive to solve, could now be easily answered.

Kai enjoyed tremendous job satisfaction working on this research frontier in applied geography. All players interacted well and there was a spirit of excitement in constructing something new, distinctive and powerful. Management appreciated the new information products prepared by the department.

As Kai's GIS system was nearing completion, the firm was purchased by another chain. The new owner, not surprisingly, decided to keep the GIS research unit in place and expanded its scope to include data on all the stores in the newly-joined system.

Now, with roughly 250 stores in the system, a new data collection process was necessary. Management looked to Kai for leadership in this field. Kai's department put new approaches to collecting more and better data at low costs into place. For example, the department devised new types of questionnaires to collect data on the residential locations of customers along with such variables as age, sex, income, etc.

Kai is one of the most proficient users of the specialized computerized GIS system which he helped to develop. He spends a good deal of his time working with this system to produce high-quality, valuable information for management.

Kai's alma mater asked him to teach an evening course on applied GIS. This course is aimed at geographers who are updating their skills. Kai is happy with his current position. He believes he has ample opportunity for advancement in the area of retail and geographical market research while still applying his geographical skills on a day-to-day basis.

Summary

This section has identified several potential employment areas for geographers. The case studies are authentic and outline the actual career paths of 19 recent graduates. They illustrate the many ways in which geography can prepare students for a wide range of professional careers.

As with any academic area, not all geography graduates find related employment, nor do all of them seek it. There is, however, a proven and growing acceptance of geographers as problem solvers by employers in the fields outlined above in both the public and private sectors. Geographers are increasingly being promoted to management positions.

In most research-oriented occupations, preference is given to four year honours graduates who specialize in that particular field, or geographers with master's degrees. Graduates with previous practical work experience, or relevant research experience gained through related senior paper topics, also have a competitive edge in the market place.

Photo courtesy of: Atmospheric Environment Service

Meteorology involes the use of sophisticated weather testing equipment, such as the radiosonde pictured above.

4

Occupations in Which Some Training in Geography is Highly Advantageous

Most of the occupations outlined in this chapter require university training. Geography strongly relates to all of them, in some way. In most cases, the training programs for these occupations do not require geography courses, but as options they prove to be very useful.

Occasionally a graduate in one of these fields will go on to do graduate work in geography as a result of his or her contact with the subject in an undergraduate program.

The Cartographer

Cartographers, or map makers, need not be geographers to practise their profession. While a few conduct geographical research or teach, most actually make maps and don't need training in geography. Nevertheless, the relationship between cartography and geography is very strong.

From the earliest times, people have needed maps and have relied on cartographers to provide them. Geographers must understand at least the basics of map making and cartographers need some knowledge of the areas or features they are portraying.

Cartography has three major phases: planning and design, compilation and editing, and drafting or map production and printing.

Cartographers design maps to meet specific objectives. One map's simple objective may consist of showing the route from one town to another. Another might be a thematic map for an atlas showing annual rainfall.

Another map might be designed to show all the important features of a densely populated area; the houses, streets, shops, industries, land surface features, highways, railways, population, and so on, in one complex picture.

Cartographers, either alone or as part of a team, must determine the most suitable size, or scale, for the map in the light of their objectives. They must sometimes design dozens of symbols to represent the features of the area being mapped in such a way that those features will show clearly and readily and will not, when seen together, create an unnecessarily muddled and confusing pattern. They must also decide which colours to use, the sizes and style of type, and the position of the map's key or legend and other explanatory devices.

Planning and design, then, requires skill and understanding on the part of cartographers and the very best ones deserve to be called artists.

Cartographers assemble data depicted on maps from a variety of sources. These sources include field surveys, photographs (especially aerial photographs), statistical tables, written material, and other maps. The assembling of these data is known as compilation. It requires cartographers to do considerable research in addition to the work of planning and design.

Cartographers make judgements about the quality of other maps used. They interpret the aerial photographs, evaluate the written material, and select the appropriate statistics. They also play a key role in the choice of names. They must consult gazetteers and geographical dictionaries in making their choices.

When they compile all the data, cartographers usually find they have much more information than they can possibly show on the map they have roughly designed. They must carefully select what they absolutely need and ruthlessly reject the rest. In this way, they meet the objective of the map and also keep it clear and capable of interpretation.

In dealing with the quantities of material to be shown, such as the number of bushels of wheat produced in one census division or the value of retail trade in a large city, the cartographer makes many mathematical calculations and specific decisions on methods of depiction.

Established cartographers do not usually draw maps in their final form (this work is done by a junior or lower level cartographer). However, their grasp of the production techniques is strong because they likely have done considerable map work during the training

period and earlier years.

Cartographers give detailed instructions to production cartographers and make sound judgements about the various thicknesses of line, selection of symbols, colours, lettering and so on.

Modern cartographic techniques require training in the uses of rather sophisticated equipment. Special scribing tools and high resolution photographic equipment are necessary for the production of today's multi-coloured maps.

Finally, the cartographer works closely with the photographer and printer who are responsible for the accurate reproduction of the original map in thousands of printed copies. The cartographer ensures the copies are exact duplicates of the original in colour density, uniform distribution of ink and accurate registration.

Most cartographic projects are restricted to a budgeted estimate. The cartographer must be aware of production and reproduction costs and determine the appropriate cartographic and photographic techniques.

Every year, more cartographic work is done with computerized GIS. In many larger firms and government agencies, computerized design, testing and production of maps has now largely replaced traditional hand production methods.

GIS map design and production has many advantages over hand methods. With a GIS, cartographers rarely need to start a project over again when a map doesn't look just right. They simply erase the change which produced the undesirable effect. Experimentation with different degrees of detail, different symbols and different colours is possible in a short period. The storage of many paper copies of maps is no longer required. Many people can view the same map at different computer terminals without the costly movement of a physical sheet.

However, one disadvantage of making map design and production appear simple is that many people without training in cartography or geography are now involved in the process. Although the potential for producing better maps exists, unfortunately, in some environments, the quality of the final maps has gone down.

Skilled cartographers with training in GIS and geography are in heavy demand in today's economy. They command premium wages. This situation is likely to continue to at least the end of the 1990s. Cartographers find work in federal, provincial, and municipal levels of government, or government funded projects and in private business and industry.

The Meteorologist

A meteorologist is a highly trained scientist who studies the structure and behaviour of the atmosphere. Many are in the profession of weather forecasting, but the term also includes those engaged in pure and applied research and those teaching the subject at the university level.

Meteorologists in weather forecasting usually work for the Atmospheric Environment Service of the federal government. Many work at major airports. However, there are a few working in private business and communications as forecasters and consultants.

Meteorologists handle hundreds of readings of atmospheric conditions fed into their regional offices from points all over the country (and, in the case of Canada, from various points in the United States).

They oversee the plotting of those readings on maps (the actual plotting is done by technicians), and read and interpret the patterns revealed by the maps. Using those patterns, they make forecasts of weather conditions that will develop in the next few hours, days, and several weeks. Much of their work involves the use of statistical methods, sophisticated simulation models, and computers.

Meteorologist go through a long and rigorous academic training. Usually, the meteorologist completes a bachelor's degree in mathematics and physics and then proceeds to a master's degree in meteorology.

Meteorologists do not require courses in geography to gain their degrees, but many find courses in world climatology, climate classification, topography, and map reading and interpretation very helpful in understanding the broad picture.

Recognizing a region's major landscape features and knowing how those features affect weather patterns and, in turn, are affected by weather patterns, allows meteorologists to make more accurate forecasts and intelligently predict effects on crops and the extent of environmental damage that might result from major weather disturbances.

The Meteorological Technician

Meteorological technicians make and record detailed weather observations of air pressure, air temperature and humidity, and wind in both the lower and the upper atmospheres. They work in direct association with meteorologists.

The equipment they work with is often very sophisticated and considerable training and experience are necessary to operate it efficiently.

Meteorological technicians do not go through as long or as rigorous a training as meteorologists. However, they should be high school graduates, especially strong in mathematics and physics. Courses in physical geography (landforms and elements of climate and weather), the essentials of map reading and interpretation, and drafting are especially useful in their training.

The Geologist

Geologists study the composition, structure, and history of the earth. Like geographers, they work in all three major employment sectors: teaching (at secondary school and university levels), government and, to a far greater degree than geographers, private business and industry.

The profession is particularly important in Canada, because of the country's enormous mineral wealth. Geologists are engaged in many endeavours. They explore extensively in the field searching for new mineral deposits. They advise on geological conditions, design, read, and interpret geological maps, work for museums, perform laboratory research, plan and manage mines and mining companies and so on.

A professional geologist gains a bachelor's degree in geology. Like the meteorologist, the geologist does not require geography to complete his or her degree.

However, most geologists find courses in geomorphology (the science of landforms), map reading and interpretation, climatology, soils and surveying necessary to round out their preparation for professional work. Today, many geologists use GIS techniques in their research.

The Economist

Economists study the production, distribution, and consumption of wealth or goods and services. They conduct research and devise plans to aid in the solution of problems arising from such processes.

Economists may work in government agencies or in private business and industry. Compared to geographers, a lower proportion teach secondary school, although economics courses are now offered at the high school level.

Many economists go into university work, where they combine teaching with research in a variety of fields. University economists study and develop basic economic knowledge. They also act as consultants conducting special research into practical questions for government and private business firms.

Government economists deal with problems related to public activities and the effects of one sector on the other. Their work strongly reflects the policies of the political party in power. They conduct investigations into matters such as tariff changes, trading policy, industrial development, employment and wage rates, income and farm markets.

Economists who work in the private sector provide management with some idea of the broad economic and political factors affecting the whole situation in which the company works. By forecasting and alerting management to business trends and cycles, they bring them to some significant level of readiness to cope with market developments.

In carrying out this work, economists may consult geographers who advise them on the spatial aspects of the various questions. Consulting firms conducting economic analyses routinely hire geographers because of their broad training, outlook and research skills.

Economists today can make more sophisticated and mathematical analyses with the use of the computer. Like meteorologists and geologists, economists do not require geography in their university training.

Many economists, however, have taken courses in economic geography to gain an important awareness of the spatial distribution of goods and services across a country or across the world as a whole.

Courses on the geography of population and on the geography of various major economic activities such as agriculture, fishing, forestry, resource management, manufacturing, and transportation

and trade are important supplements to the economist's formal-training. Practising economists often consult geographic literature.

The Architect

Architects design and direct the construction of buildings, building sites and occasionally entire settlements. Like geographers, they are concerned with the total environments of areas. However, the areas they deal with are usually much smaller than the geographer's regions and they must pay more attention to detail. Their work frequently takes them out of the office and into the field.

Architects concentrate on design, mathematics and science in a university program that usually takes five or six years to complete.

Architects in urban and regional planning are in regular contact with urban geographers and with physical geographers engaged in site analysis and micro-climatic conditions that affect a building's location and design.

Courses in urban geography, environmental studies, and certain aspects of climatology are valuable in an architect's training. Every year architects spend more time at terminals working on computer-aided-design (CAD) and similar powerful software products. These tools make many once onerous tasks quite straightforward. CAD systems are similar to GIS in many respects; they simplify and automate design and measurement.

Architects and geographers often end up working together - at different scales - on large projects and even use each other's computer files.

The Architectural Technologist

Architectural technologists assist architects in all phases of their work, both in the office and in the field. A very important part of an architectural technologist's work is the preparation of drawings and of three-dimensional models to illustrate in detail the architect's design proposals.

The technologist needs considerable artistic skill in this work, and facility in the reading and construction of maps is necessary.

Before various contractors receive the drawings and models for estimates of construction costs, the architectural technologist draws up a set of detailed written instructions called specifications, and he or she must organize information logically and write clearly to do this.

In the final stages of a development, the architectural technologist may inspect and supervise work at the construction site. The technologist determines whether or not the contractor is correctly interpreting the architect's plans and carrying them out according to specifications.

Architectural technologists are usually graduates of post-secondary institutions or colleges of technology.

Ideally, the technician should have basic courses in urban geography, topography, the essentials of map reading and interpretation, and computer-aided-design (CAD).

The Forester

A forester is a university-trained scientist. Foresters research, develop, and manage forests and associated wild lands for the continuous production of forest resources.

Foresters are employed chiefly by government agencies and large forest product companies. The forester's work is significant for Canadians because our forest resources are so important to our economy and are subject to considerable exploitation by foreign enterprises.

Foresters work in one of the major divisions of the environment. They study the interrelationships of tree types, tree growth, temperature, humidity, soils, topography, solar energy, disease, replanting strategies, and technology.

Foresters must be vitally concerned with conservation, ecology and environmental quality. Courses in plant and soil geography, topography, climatology, ecology, economic geography and map reading and interpretation are desirable in their training.

Many forestry schools require and encourage their students to take at least some of these courses in their respective programs.

G.C. file photo

The Eaton Centre (Toronto, Ontario)

G.C. file photo

The Eaton Centre (Toronto, Ontario)

5

Geography and Living

Preceding chapters of this book have provided you with information about many specific occupations for which training in geography ranges from being useful to essential.

There are many other occupations for which some training in geography provides effective preparation. Even in everyday living, in the pursuit of leisure and recreation and in travel, a general knowledge of geography can enhance your awareness of the world and improve the quality of life.

You are already, in fact, something of a geographer. You deal with the location of things, why they are there, how they interrelate, and the importance of their location.

Here are just a few basic examples, among many possible ones, of how geography is important to virtually everyone.

Preparing Yourself for a World of Systems

The society we live in is a complex system with various interrelated parts. This has not always been true. In the past, an event in one part of the country would often have very little, if any, impact on another part.

Today, we live in a "global village". What happens on one side of the world (let alone within the same country) usually has an immediate effect on the other side.

Within this complex structure or system there are countless smaller systems. Even a small company is a system because it has interrelated parts or functions. To understand the operations of any one job, you need to understand at least the general operation of the overall system.

Geographers, with their emphasis on how things are interrelated, recognize the ways in which many basic systems work. A course in economic geography would, for example, show students how a successful steel company depends upon availability of raw materials, developing effective ways of getting transporting materials, designing and implementing special machines to change the raw materials to various products, maintaining reasonable costs, using efficient modes and schedules of transportation and similar factors.

More important, they would see how jobs or functions are interrelated, whether the job is selling business machines, directing several office operations, evaluating a new proposal for a bank loan or coordinating the activities of a major construction job. Students would be better prepared for almost any kind of work through this type of study.

The Widespread Use of Databases, Charts and Maps

Databases, charts (tables of information) and maps are, of course, enormously important in geography in general. It would be incorrect, however, to assume that the skills of querying, reading, interpreting and constructing these devices are important only in this field. They have widespread applications in the world of business and modern civil service as well. Virtually every business enterprise deals with information in chart form and uses maps of various kinds sooner or later.

Students who have studied statistical tables know how important it is to present information in an organized form. They can arrange a mass of details so a few basic facts are revealed. They know they must carefully group items under appropriate headings and must state those headings clearly and concisely.

They must rank items in some order, for example, in order of value, so the table can be easily followed. They also know to state the sources of information so the reader can obtain more data on the subject concerned and can see what biases may be built into the information.

When writing or interpreting reports containing charts, these ideas about the organization and presentation of information will not be new to these students because they studied and produced charts as part of their education.

Maps vary greatly in scale, in the detail they show, in the

symbols they employ and in the quality of the design. However, any picture viewed from above is essentially a map.

We use maps to convey information about literally hundreds of situations in which location is of some importance. A blueprint showing the precise location and size of various buildings and equipment of an industrial property is a map. The construction workers and the architect must be able to read it correctly, along with key persons in the firm itself involved in the dozens of operations of the company.

A floor plan of an office or warehouse, showing the location of furniture, electrical outlets, water pipes, lighting fixtures, entrances and exits, and so on, is also a map.

People in charge of shipping products and people to various destinations - taxi drivers, truck drivers, delivery persons and others - must read street maps and road maps to perform their duties efficiently.

A knowledge of direction, of standard symbols, of the relationships between the map and the actual area in terms of shapes, sizes, and distances, is a very basic knowledge you can apply in many everyday situations.

A General Knowledge of Your Community

We live in an urban age. Eight out of ten Canadians reside and work in towns and cities. It is, therefore, of crucial importance that we gain at least a general knowledge of our urban areas. We must understand their various components and how they act upon one another to create our complex urban environments.

For business or government professionals, this knowledge is particularly important. With an intelligent overview of your community, its economy, culture and comparative advantages, you will have a greater chance of success in most careers.

You will have a better understanding of the particular role that you play, of the people you will contact, and of the special problems your company has in its business relations. You will have a host of other advantages that less informed persons just do not have.

Many high schools today offer courses in urban geography. They are interesting and relevant courses because they involve everyday problems we all have to face.

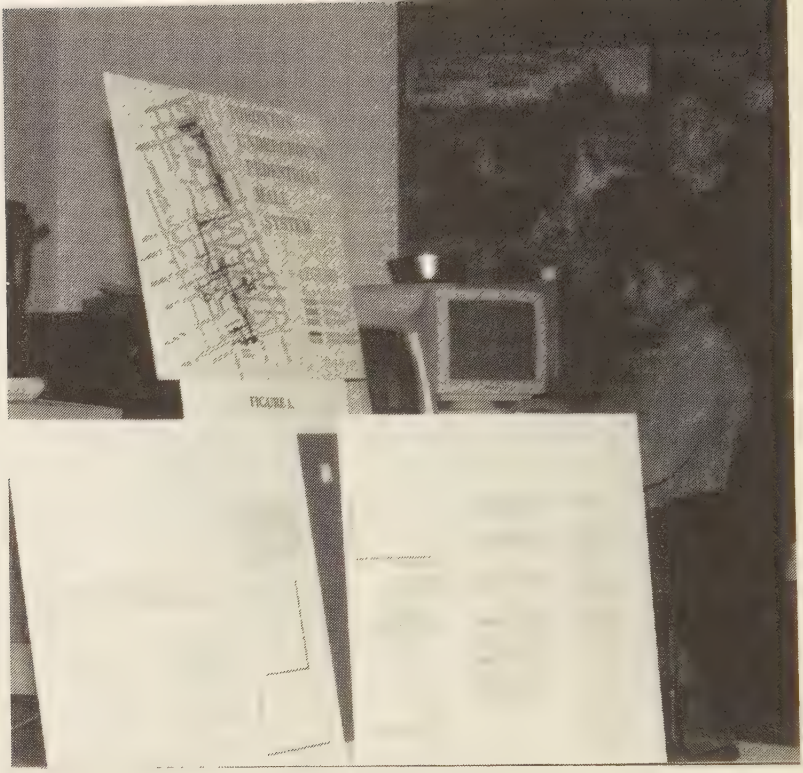


Photo courtesy of: Anthony Lea, Department of Geography, Ryerson Polytechnical Institute.

Geographers often prepare presentations and models using specialized computer software and display materials.

In Conclusion

You have seen many examples in this book of the importance of geography to prepare you for any one of many possible occupations.

The highway planner studies where new roads should be built, why traffic flows are generated, where they are likely to develop and the best expenditures for public money. The town planner studies the existing land uses of a given area to understand how they develop and where and how to change them in the future to improve our urban environments. Both professionals use maps showing where items were, where they are at present and where they might be in the future. It is the cartographer who is responsible for preparing the information in that form.

The architect studies the location and the design of buildings, determines where to locate a variety of amenities, both within and around the buildings.

In working with powerful GIS and automated mapping systems, geographers can study the interrelationships among a great many factors. In the world of business, virtually everyone has to consider how the system in which he or she works operates and how its parts affect one another.

The sales manager allocates sales resources amongst regions under increasingly complex circumstances. This requires a broad knowledge of what is going on in each region.

Today, geography teachers in high schools and universities are very concerned with providing opportunities for students to develop their thinking powers. This helps them develop skills in recognizing patterns in large masses of detail, in writing reports, and in presenting information in chart, table, and map form - skills that are widely applicable in many occupations. In short, geography is vital in the working world.

Photo courtesy of Anthony Lea, Department of Geography, Ryerson Polytechnical Institute.

Photo courtesy of: Richard P. Baine

Geography provides a useful background for a variety of interesting careers.

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For further information, see the following materials, published by the Guidance Centre, OISE, and available at your guidance office, career training centre or local library:

The Occupational Information Monograph Series,
The Job Profile Series,
and other books in *The Student, Subject and Careers Series.*

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